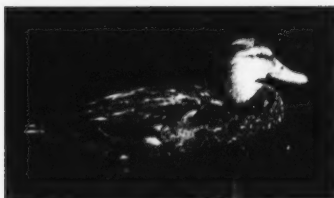


Annual report
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Black Duck Joint Venture Helicopter Survey in Québec



Daniel Bordage et Christine Lepage
Canadian Wildlife Service
Québec Region



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de la faune**

2002 Black Duck Joint Venture Helicopter Survey – Québec

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Canadian Wildlife Service
Québec Region 2002

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To find out more about the American Black Duck and many other waterfowl species, and to follow up the Black Duck Joint Venture activities in Québec, visit our Web site at the following address:

<http://lavoieverte.qc.ec.gc.ca/faune/sauvagine/html/waterfowl.html>

Readers should note that this publication uses the International System of Units: thousands are separated from hundreds by a space (53 833 km²; 1 231 448 pairs), and decimals are separated from units by a comma (9,98 pairs/100 km²; -7,8°C).

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1.0 Introduction

The main objective of the Black Duck Joint Venture (BDJV) survey is to provide statistically reliable indices of breeding population trends and relative densities of American Black Duck (hereafter, Black Duck) and other waterfowl species throughout the primary breeding range of the Black Duck. The BDJV study area in Canada includes the provinces of New Brunswick, Nova Scotia, Newfoundland (including part of Labrador), Québec (southern part) and Ontario (east-central). This huge territory was divided in 4 strata to reflect the distribution of 3 different Black Duck populations according to banding reference units, and ecozones. Stratum 1 is in the Atlantic Maritime ecozone. The 3 other strata are in the Boreal Shield ecozone which was divided approximately according to the banding reference limits in Canada. The 70°30' west meridian of longitude divides Stratum 2 (Eastern Boreal Shield) from Stratum 3 (Central Boreal Shield). The 76°30' W divides Stratum 3 and Stratum 4 (Western Boreal Shield). Strata 1 and 2 are part of the same banding reference unit. Each spring, the study area is surveyed twice, (a) by the Canadian Wildlife Service (CWS) using helicopter and (b) by the U.S. Fish and Wildlife Service (USFWS) using aircraft (usually referred as the fixed-wing survey). This report deals with the BDJV helicopter survey in Québec.

2.0 Methods

The BDJV helicopter survey covers approximately 503 800 km² of the Black Duck's main breeding grounds in Québec. The study area includes most of the Boreal Shield Ecozone (Bird Conservation Region [BCR] 8, Boreal Softwood Shield, and BCR 12, Boreal Hardwood Transition) and the northern part of the Atlantic Maritime Ecozone (BCR 14, Atlantic Northern Forest; Figure 1). Québec's coverage of the eastern Canada survey includes parts of Strata 1, 2 and 4, and all of Stratum 3. The survey began in 1990 with 83–10×10 km (100 km²) plots systematically distributed within the study area. Beginning in 1996, plot size was reduced to 5×5 km (25 km²) and a rotational plot design was implemented. The transition to this new system was made possible without losing long-trend analysis capability by keeping most of the southwest 5×5 km quadrants from the original set of 100 km² plots. In the rotational design, a letter (A, B, C or D) was randomly assigned to the plots of each stratum. Half of the plots (78) are surveyed each year beginning with Plots A and B in the first year, B and C in the second year, etc. Each of the 156 plots are surveyed twice over a 4-year period. The 78 plots surveyed in 2002 were exactly the same as those surveyed in 1998 (Plots C and D).

The same survey method was used throughout the 1990–2002 period. Surveys are flown in a Bell 206L (Long Ranger) helicopter equipped with skids and bubble windows to enhance observers visibility. All waterbodies and wetlands within the plots are surveyed. Depending of the habitat and topography, surveys are flown at 15–50 m above ground level and at 60–100 km/h. The survey crew consists of 2 observers in Stratum 1, and 3 observers in Strata 2, 3 and 4. All waterfowl observations (see Appendix 1 for scientific names of species) as well as several other birds, mammals, and reptiles species are directly recorded by the front seat observer on 1:50 000

topographic maps of the plots and later entered into a computer database. Basic data recorded for each individual or group of birds observed (i.e. one record per observation) are: 1) plot identification; 2) date; 3) location of the birds (UTM); 4) species code; 5) number of males; 6) number of females; 7) number of birds of unknown sex. Indicated pairs in this report are calculated using the standardized method developed for the BDJV helicopter survey in Eastern Canada (Appendix 2).

The survey is carried out during the nest-initiation and the beginning of incubation period of the Black Duck, an early nesting duck species. To determine the timing of the survey relative to nest initiation, we calculate a phenology index (PI) which is the ratio of the number of paired males (1 male + 1 female) to that of unattended males (lone and flocked drakes). A PI of 1,0 is considered optimal for the Black Duck and other species with sex ratios closed to 1,0 and should be indicative of a survey made when half the pairs involved in nest-initiation and the other half had started incubation. A PI value much greater than 1,0 should indicate a survey early in the breeding season where migrants are still in the area and breeding pairs may not be on their nesting territories, which could result in an overestimation of the breeding population. On the opposite side, a very low PI would indicate a late survey relative to the nesting phenology where some pairs may be missed because drakes are abandoning the nesting hens (for most species, incubating females cannot be counted from the helicopter). The latter situation leads to underestimation of the indicated pair numbers.

3.0 Results and discussion

3.1 Spring conditions

In Quebec, the winter was mild, March and April were warm, but the temperature dropped during the survey in May and stayed cold up to the last day of the survey, June 3rd, when we got heavy snow precipitation at about one hundred kilometers north of Québec City. Mean temperature was the second coldest since the beginning of the survey in 1990; the record low temperature was observed in 1996 (Table 1). Many lakes were still frozen during the survey; at least one completely frozen lake was observed in 20 out the 78 plots. The Lake Saint-Jean ice thaw which gives us an idea of spring conditions in central Québec (Stratum 3) was the earliest date recorded since 1990 and the seventh earliest since 1916 (1990–2002 average ice thaw = 9 May; Table 1). This observation can seem odd knowing that the spring was late, but because of the mild winter, the ice was probably thinner than usual and warm temperatures in March and April could have result to the early ice-thaw observed. Weather conditions were fair to poor throughout the nesting period and the beginning of brood-rearing which could have a negative effect on reproduction.

3.2 Achievement of survey

Every plots were surveyed by experienced observers. Daniel Bordage, Christine Lepage and Shirley Orichefsky covered all plots in Strata 2, 3 and 4. The 4 plots of Stratum 1 were covered by Myrtle Bateman and Randy Hicks. The survey was undertaken between 29 April and 3 June 2002 (1990–2002 average = 6–30 May; Table 1). Times

on plots were similar to those recorded in previous years (1996–2002 average = 32 min).

3.3 Phenology indice

Table 2 shows that most species had phenology indices (PI) slightly above the optimal value of 1,0. This result confirms two things: firstly, the 2002 survey was done early in nesting period when most birds are in pairs (this situation was expected knowing that the spring was late) and secondly, the close to 1,0 PI values indicate a good survey timing overall.

3.4 Populations trend

Numbers of indicated pairs are shown in Table 3 for all loons, geese and ducks species breeding in the study area and consistently observed during the survey. With a total of 389 347 indicated pairs, 2002 has the second highest count on record since the beginning of the survey in 1990 (Table 3). This 2002 estimate of total population is 19% above the 2001 estimate of 327 728 indicated pairs and 41% above the long term 1990–1999 average of 276 662 indicated pairs (Table 4). This year increase compared to last year was observed both for the total IP numbers of dabblers (*Cairinini* and *Anatini*; +13%) and for the divers (*Aythiini* and *Mergini*; +24%).

The 1990–2002 trends of the various species surveyed are shown in Figures 2 to 27. Overall total number of ducks have increased since 1990 to a record high estimate in 2000 (Figure 2). This long term increase was observed both for dabblers and divers. However, divers, who were more abundant than dabblers from 1990 to 1995, are showing comparable densities and trends since 1996 (Figure 2). This situation results from a significant increase of dabblers population in 1996.

The number of Common Loon indicated pairs seems to have leveled since 1995 to a breeding population twice that observed in 1990–1992 (Figure 3). Let's not forget that the low estimation of 1996 resulted from late ice thaw that year for many large lakes used by loons. Following a steady decline from 1990 to 1995, the Canada Goose breeding population in the southernmost part of their distribution range had increased considerably since the hunting season was closed in 1995 (Figure 4). However, a decline was observed in 2002 for a second year in a row. This recent decline coincides with the end of the ban on Canada Goose hunting in 2000 (partially open seasons in 2000 and 2001). It will be of interest to look at the results next year after the full 2002 open hunting season in Québec. Overall, both the Atlantic Population (AP; Strata 3 and 4) and the North Atlantic Population (NAP; Stratum 2) showed a similar trend since 1995 but the range of variations was lower for the NAP (Table 5; Figure 5). The number of nests recorded (stated as number counted per 100 km² to account for differential yearly sampling effort) showed similar patterns than the indicated pair trends (Figure 6) but with more variations. Each year we also estimate clutch size of Canada Goose nests observed from the helicopter. Nine nests were observed in 2002 (Table 6). The clutch size estimated did not vary much around the 1990–2002 average of 4,45 eggs/nest (Figure 7). The Black Duck breeding population in the study area increased by 19% in 2002 compared to last year (Table 4). Overall, the Black Duck population is increasing since 1993 (Figure 10). Mallard IP numbers rose quite

consistently since 1990 (Figure 11) despite a 27% decline this year compared to 2001 (Table 4). The second most abundant waterfowl species in the study area, the Ring-necked Duck, also dropped down in 2002 (-21%) to a breeding population estimate 18% below the 1990–1999 long term average (Table 4; Figure 15). The Ring-necked Duck and the Mallard are the only two of the ten most abundant species to show a 2002 estimate below the long term average (Table 4). The Common Goldeneye indicated pair numbers increased by 41% this year compared to 2001 (Table 4) and the 2002 estimate for this species is a record high since the beginning of the survey in 1990 (Figure 22). Record high IP estimates were also recorded in 2002 for three other species: the Bufflehead (Figure 24), the Hooded Merganser (Figure 25), and the Common Merganser (Figure 26).

4.0 Conclusion

The BDJV helicopter survey allows us to reliably evaluate breeding population trends and relative abundance of 20 species of loons and waterfowl in southern Québec. A look at the trends figures reveals acceptable year-to-year variations as well as fairly smooth tracks of yearly population changes for most species. The precision of annual indicated pairs estimates (see SE) is good for the most abundant surveyed species. Annual coefficients of variation were usually below 10% for Black Duck and below 20% for many other abundant species.

Over the years, the BDJV helicopter survey proved to be a valuable and effective tool for evaluating population trends and relative abundance of Common Loon and waterfowl species breeding in southern Québec. 2002 was the thirteenth consecutive year of the BDJV survey program in Canada.

Table 1. Sample plot size, sampling effort, habitat and weather conditions recorded during the Black Duck Joint Venture Helicopter Survey in Québec 1990–2002

Descriptor	1990–1995	1996	1997	1998	1999	2000	2001	2002
Plot Identification	– ^a	A–B	B–C	C–D	D–A	A–B	B–C	C–D
Plot size (km)	10×10	5×5	5×5	5×5	5×5	5×5	5×5	5×5
Surveyed area (km ²)	3500–8200 ^b	1950	1950	1950	1950	1950	1950	1950
Sampling effort (%)	0,7–1,6 ^b	0,4	0,4	0,4	0,4	0,4	0,4	0,4
Beginning of survey	2–11 May ^b	6 May	12 May	5 May	6 May	4 May	6 May	29 April
End of survey	23 May–4 June ^b	24 May	6 June	29 May	31 May	2 June	30 May	3 June
Lake Saint-Jean ice thaw	7–20 May ^b	12 May	7 May	3 May	8 May	7 May	9 May	1 May
Mean temperature (°C)	8–11 ^b (–4–30) ^b	5 (–8–14) ^b	8 (1–18) ^b	13 (2–22) ^b	13 (–2–25) ^b	9 (–5–25) ^b	13 (0–25) ^b	6 (–7–21) ^b
Mean time on plot (min)	81–97 ^b (20–192) ^b	24 (13–44) ^b	34 (17–59) ^b	31 (14–51) ^b	36 (20–58) ^b	36 (19–64) ^b	32 (15–55) ^b	34 (13–52) ^b

^a The rotational sampling plan using a letter for plot identification began in 1996.

^b Minimum–maximum.

Table 2. Phenology indices (PI) of duck species observed during the Black Duck Joint Venture Helicopter Survey in Québec 1990–2002

Species	1990–1995 ^a	1996	1997	1998	1999	2000	2001	2002
DABBLERS								
Wood Duck	0,35–3,25	3,50	0,60	0,25	0,60	1,57	0,92	1,57
Green-winged Teal	0,88–10,2	6,09	0,57	0,62	1,28	5,09	0,50	2,94
American Black Duck	0,78–2,44	5,22	1,16	0,88	1,03	1,77	0,50	1,57
Mallard	0,10–1,06	0,35	0,27	0,20	0,28	0,62	0,19	1,50
Northern Pintail	0,00–1,00	0,20	– ^b	– ^b	– ^b	– ^b	– ^b	– ^b
Blue-winged Teal	1,50–6,00	– ^b	0 ^c	– ^b	– ^b	2,00	3,00	– ^b
American Wigeon	0,00–3,50	– ^b	0,50	– ^b	– ^b	– ^b	1,00	– ^b
DIVERS								
Ring-necked Duck	1,18–3,42	1,33	1,68	1,67	3,14	2,64	3,16	1,17
Greater Scaup	0,00–2,50	– ^b	0 ^c	– ^b	– ^b	1,67	– ^b	– ^b
Lesser Scaup	0,75–4,26	– ^b	0 ^c	– ^b	– ^b	0 ^c	– ^b	– ^b
Undentified scaup	1,00–4,00	– ^b	– ^b	– ^b	– ^b	2,67	– ^b	– ^b
Black Scoter	0,33–30,0	1,00	– ^b	– ^b	– ^b	0 ^c	– ^b	– ^b
Surf Scoter	0,79–5,33	– ^b	– ^b	5,00	3,60	8,00	– ^b	12,0
Common Goldeneye	0,87–1,77	1,35	0,68	0,97	1,54	1,67	1,17	1,56
Barrow's Goldeneye	1,00–3,50	3,00	0,67	0,33	– ^b	– ^b	1,75	– ^b
Bufflehead	2,25–7,57	0,60	5,00	– ^b	– ^b	1,50	– ^b	3,17
Hooded merganser	0,93–1,81	1,47	2,36	1,00	1,39	1,57	1,45	1,49
Common Merganser	0,82–1,68	1,14	1,22	0,81	1,08	1,60	1,23	1,26
Red-breasted Merganser	0,80–6,00	– ^b	– ^b	– ^b	– ^b	– ^b	– ^b	– ^b

^a Minimum–maximum.

^b No unattended male observed.

^c At least one unattended male observed but no paired male observed.

Table 3. Breeding population estimates (total indicated pairs/503 800 km²) from the Black Duck Joint Venture Helicopter Survey in Québec 1990–2002

Species	1990–1995 ^a	1996	1997	1998	1999	2000	2001	2002
LOONS								
Common Loon	14 775	10 851	25 319	18 860	24 286	21 185	19 894	20 410
GEESE								
Canada Goose	15 889	22 477	17 052	22 477	35 137	37 462	33 587	28 161
DABBLERS								
Wood Duck	2 450	2 325	2 325	1 292	4 134	5 684	6 201	4 650
Green-winged Teal	12 856	23 252	14 468	11 109	18 860	41 854	17 568	21 702
American Black Duck	80 339	106 056	94 947	107 736	155 145	158 116	121 300	144 164
Mallard	8 224	18 860	9 818	8 267	19 635	25 578	14 210	10 334
Northern Pintail	173	2 067	258	0	0	258	0	517
Blue-winged Teal	617	517	1 033	517	775	1 550	1 033	0
American Wigeon	624	1 033	1 550	0	775	7 173	517	258
Subtotal	105 284	154 110	124 399	128 921	199 324	240 213	160 829	181 626
DIVERS								
Ring-necked Duck	51 014	40 821	55 289	39 012	67 690	83 967	52 705	41 854
Greater Scaup	857	1 033	258	0	0	4 909	0	258
Lesser Scaup	2 164	517	517	0	0	258	0	0
Undentified scaup	751	258	0	0	0	4 134	0	0
Black Scoter	919	517	258	258	775	775	0	0
Surf Scoter	2 492	1 809	3 875	8 009	5 942	5 684	9 301	4 909
Common Goldeneye	41 224	39 271	42 371	32 295	49 605	57 614	45 213	63 556
Barrow's Goldeneye	1 207	1 033	1 292	2 842	517	258	2 842	258
Bufflehead	2 625	3 617	2 067	0	517	1 292	0	7 751
Hooded merganser	11 654	12 660	12 660	12 918	26 611	23 252	15 243	27 386
Common Merganser	37 998	26 094	40 046	33 845	34 620	41 079	41 596	61 231
Red-breasted Merganser	1 503	0	0	0	0	342	0	517
Subtotal	154 407	127 630	158 633	129 179	186 277	223 564	166 900	207 721
Total ducks	259 691	281 740	283 032	258 100	385 601	463 777	327 729	389 347

^a 1990–1995 mean.

Table 4. Change (%) between the number of indicated pairs (IP) observed in 2002 compared to 2001 and 1990–1999 mean; species in decreasing 1990–2002 mean IP population estimates from the Black Duck Joint Venture Helicopter Survey in Québec 1990–2002.

#	Species	Mean IP Density/100 km ²		Mean IP Population (503 800 km ²)		% Change in 2002 compared to	
		1990–1999	1990–2002	1990–1999	1990–2002	2001	1990–1999 mean
1	American Black Duck	18,8	20,9	94 592	105 346	+19^a	+52
2	Ring-necked Duck	10,1	10,5	50 889	52 879	-21	-18
3	Common Goldeneye	8,2	8,8	41 088	44 405	+41	+55
4	Common Merganser	7,2	7,7	36 259	38 961	+47	+69
5	Canada Goose	3,8	4,4	19 248	21 961	-10	+74
6	Common Loon	3,3	3,5	16 797	17 651	+2,6	+22
7	Green-winged Teal	2,9	3,4	14 483	17 381	+24	+50
8	Hooded Merganser	2,7	3,1	13 477	15 435	+80	+103
9	Mallard	2,1	2,4	10 593	12 004	-27	-2,4
10	Surf Scoter	0,69	0,83	3 459	4 191	-47	+42
11	Wood Duck	0,49	0,63	2 478	3 178	-25	+88
12	Bufflehead	0,44	0,47	2 195	2 384	+^b	+253
13	Barrow's Goldeneye	0,26	0,25	1 292	1 253	-91	-80
14	Lesser Scaup	0,28	0,22	1 402	1 098	0	-100
15	American Wigeon	0,14	0,20	710	1 024	-50	-64
16	Greater Scaup	0,13	0,19	644	945	-100	-100
17	Red-breasted Merganser	0,18	0,15	902	760	+^b	-43
18	Blue-winged Teal	0,13	0,14	655	702	-100	-100
	Undertified scaup	0,09	0,14	476	684	0	-100
19	Black Scoter	0,15	0,12	732	623	0	-100
20	Northern Pintail	0,07	0,06	336	318	+^b	+54
	Dabblers	24,6	27,8	123 846	139 952	+13	+47
	Divers	30,3	32,5	152 816	163 558	+24	+36
	Total ducks	54,9	60,2	276 662	303 511	+19	+41

^a Increases are in bold.

^b The species was observed in 2002 but not in 2001.

Table 5. Breeding population estimates of Atlantic population of Canada Goose (number of indicated pairs/350 000 km²; Strata 3 and 4) and North Atlantic population of Canada Goose (number of indicated pairs/105 300 km²; Stratum 2) from the Black Duck Joint Venture survey in Québec 1990–2002

Population	1990–1995 ^a	1996	1997	1998	1999	2000	2001	2002
Atlantic	11 407	15 638	11 863	13 211	23 726	25 613	22 108	17 795
North Atlantic	3 645	5 552	4 212	7 275	9 190	9 573	9 190	8 233

^a1990–1995 mean.

Table 6. Number of Canada Goose nests and clutch size estimates from the Black Duck Joint Venture Helicopter Survey in Québec 1990–2002

	1990–1995 ^a	1996	1997	1998	1999	2000	2001	2002
Number of nests	24 (9–39) ^b	9	5	8	15	18	22	13
Number of nests/100 km ²	0,37 (0,26–0,48) ^b	0,46	0,26	0,41	0,77	0,92	1,13	0,67
Number of nests with recorded clutch size	19 (7–37) ^b	6	4	5	14	18	18	9
Mean clutch size (SE)	4,34	5,67 (0,21)	4,25 (0,75)	4,60 (0,51)	3,79 (0,41)	4,61 (0,29)	4,56 (0,18)	4,33 (0,24)

^a 1990–1995 mean.

^b Minimum-maximum.

Figure 1. Study area of the Black Duck Joint Venture helicopter survey in Québec 1990–2002

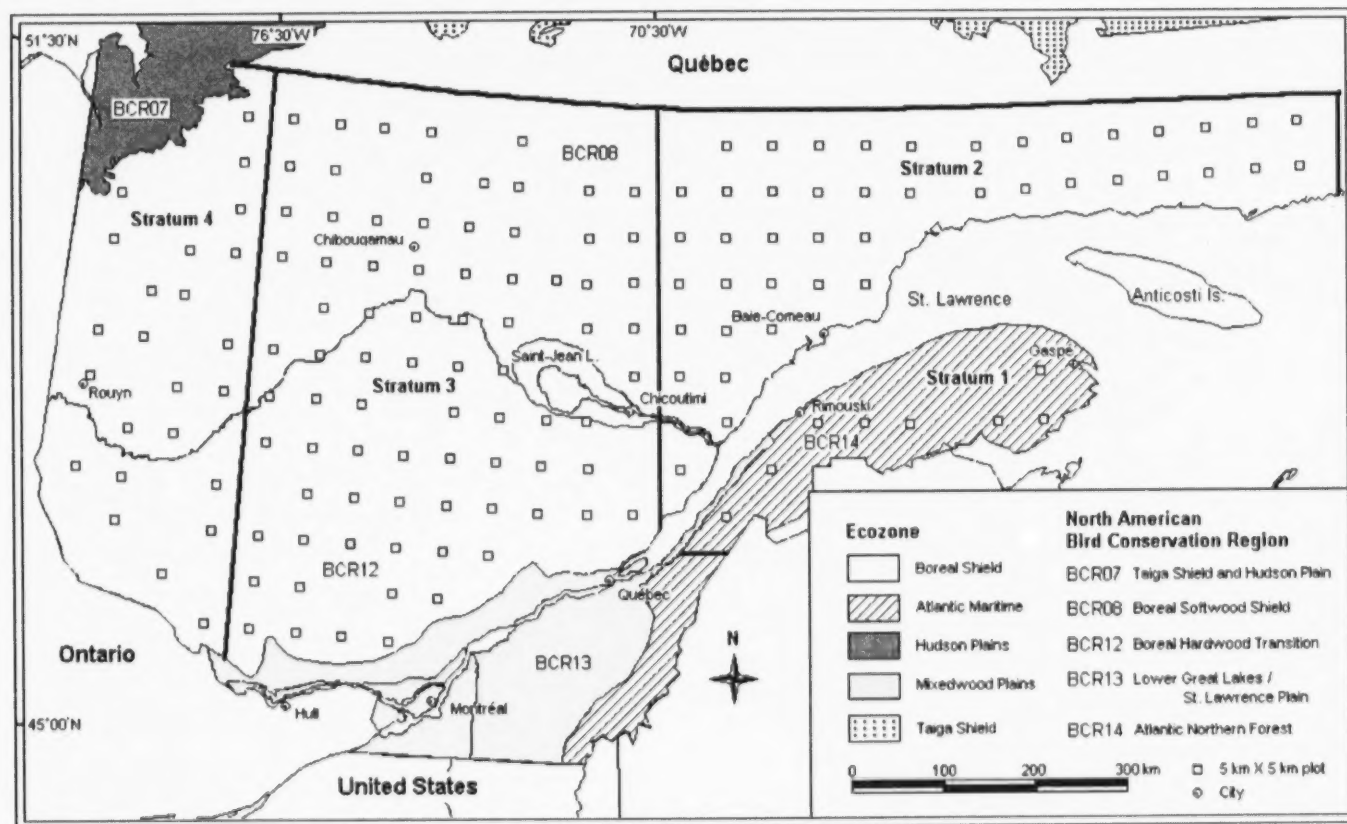


Figure 2. Trend in the breeding waterfowl population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

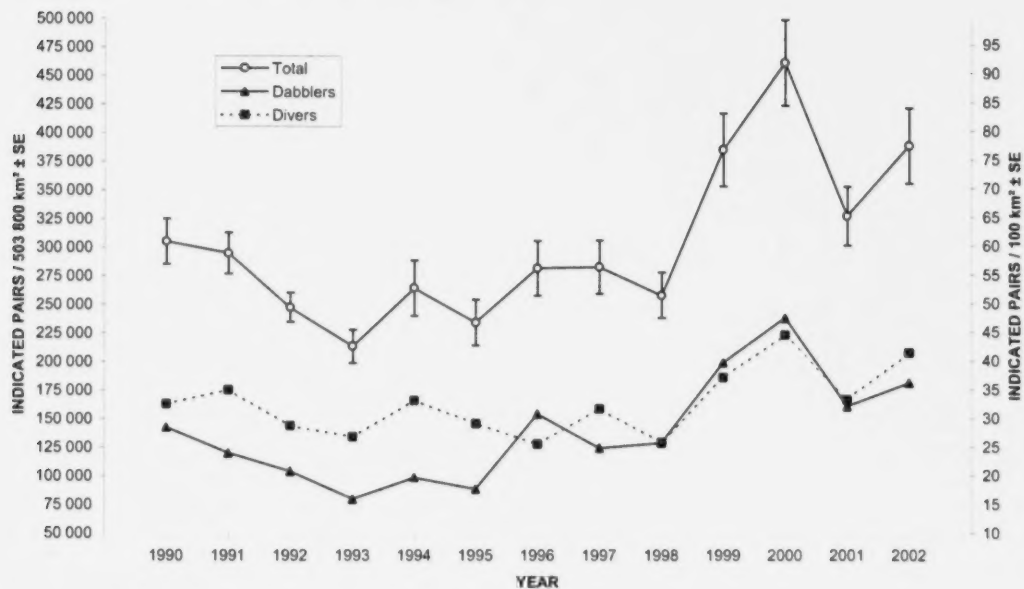


Figure 3. Trend in the Common Loon breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

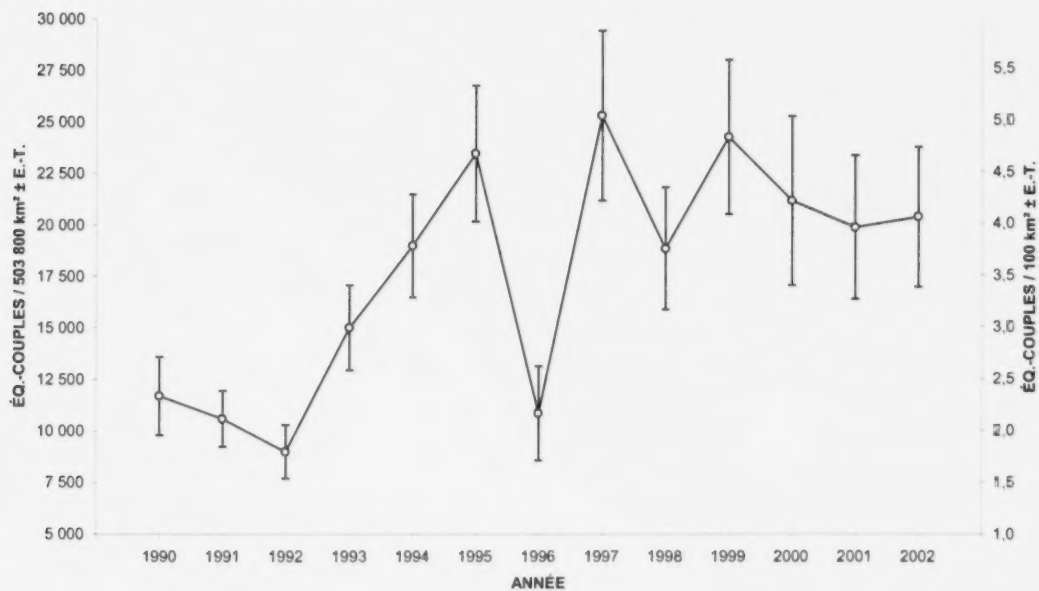


Figure 4. Trend in the Canada Goose breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

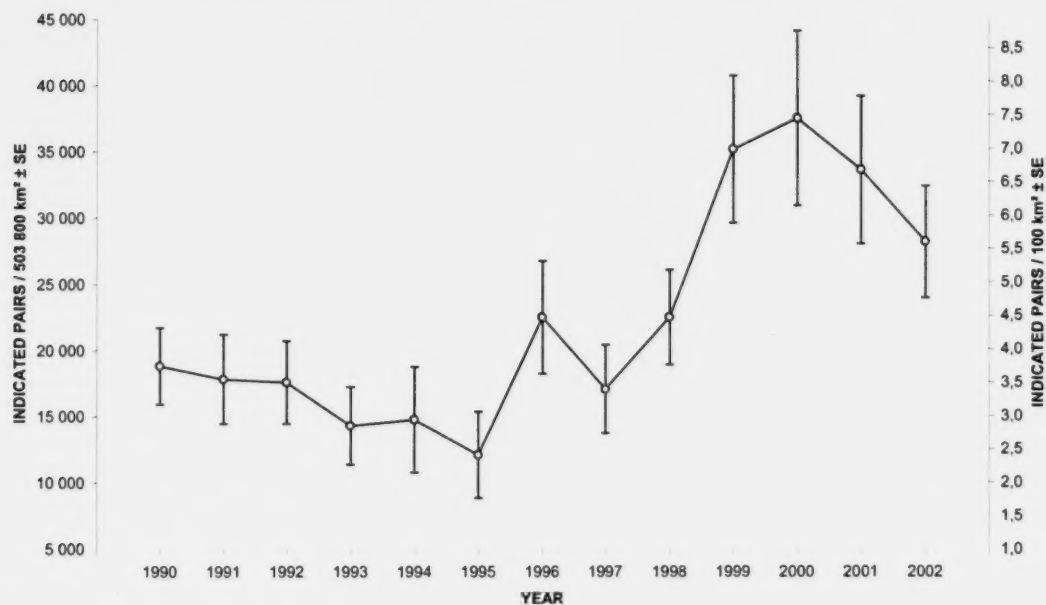


Figure 5. Trend in the Atlantic and North Atlantic Canada Goose populations in southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

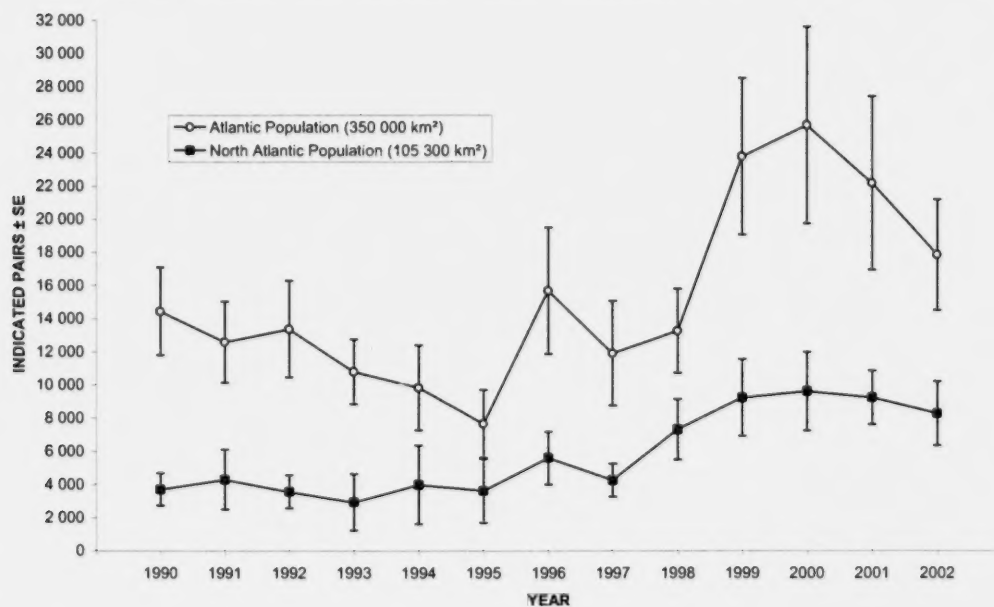


Figure 6. Trend in the number of nests of Canada Goose in southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

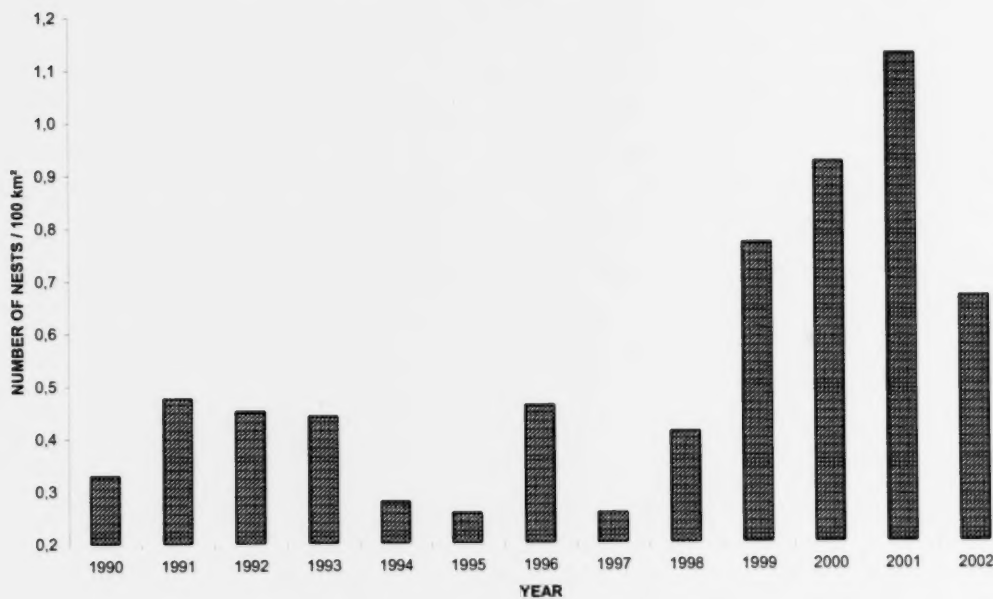


Figure 7. Trend in the Canada Goose clutch size in southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

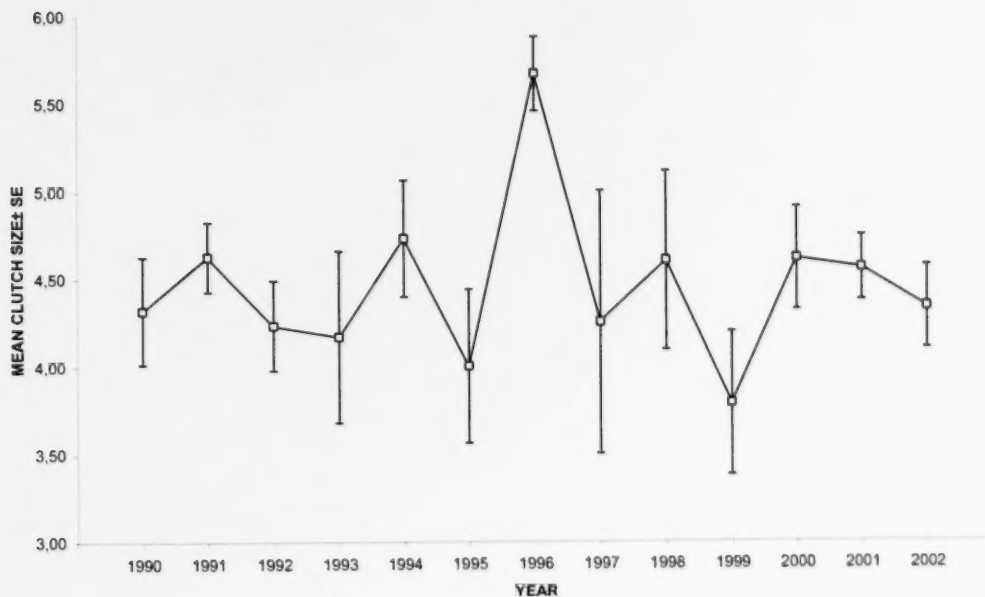


Figure 8. Trend in the Wood Duck breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

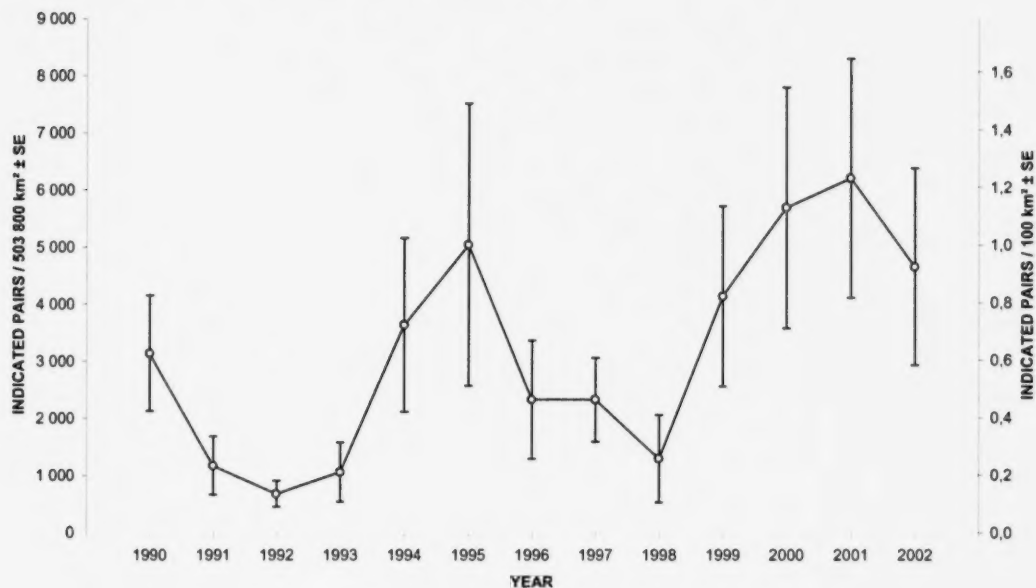


Figure 9. Trend in the Green-winged Teal breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

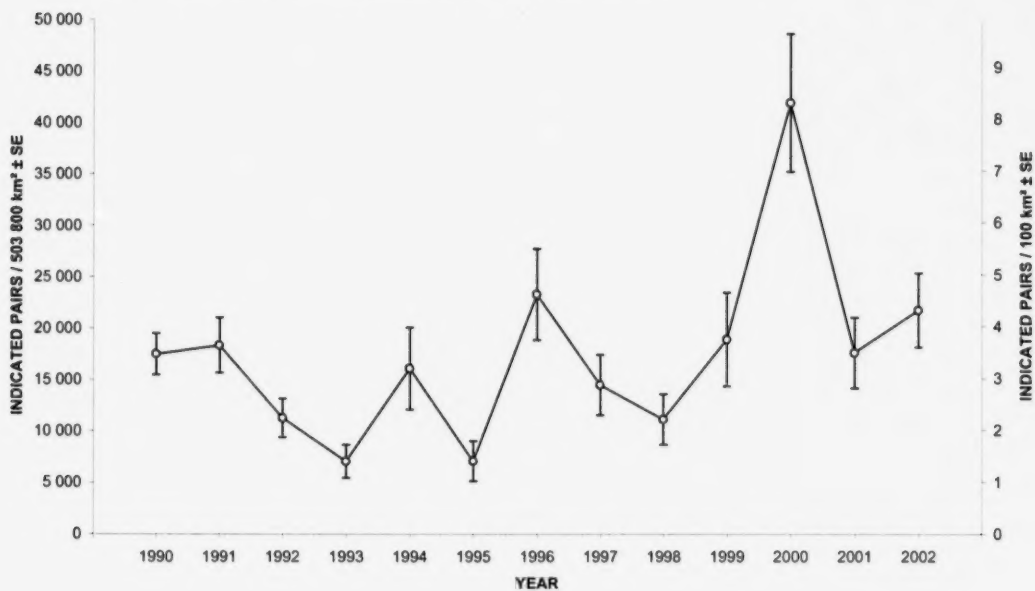


Figure 10. Trend in the American Black Duck breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

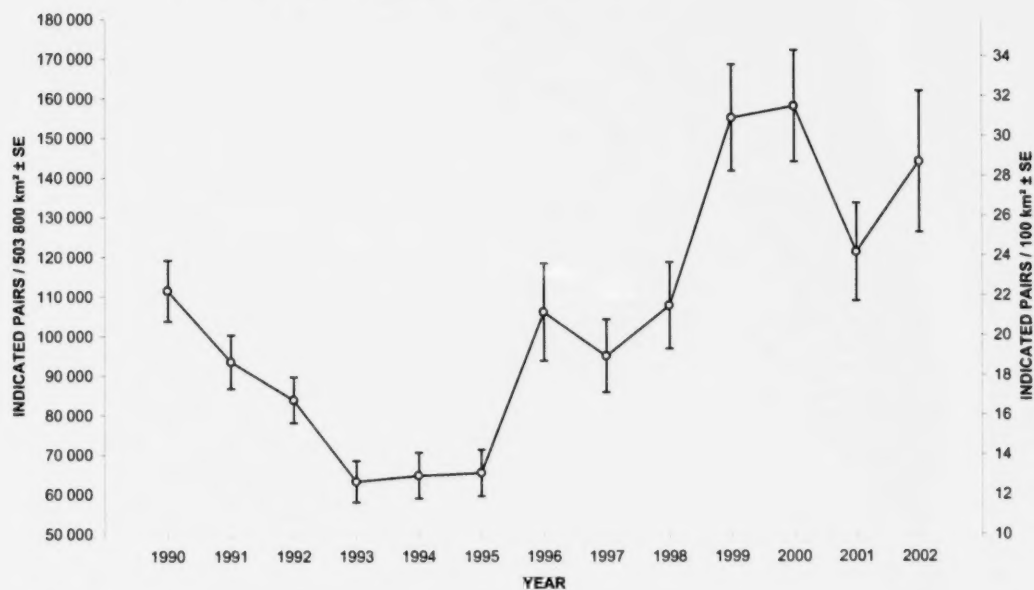


Figure 11. Trend in the Mallard breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

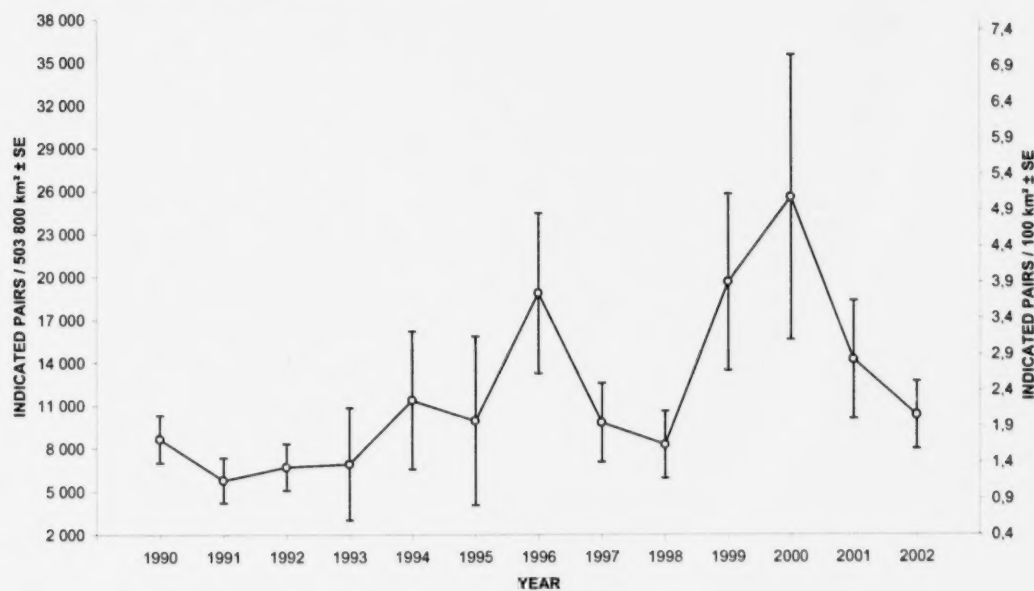


Figure 12. Trend in the Northern Pintail breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

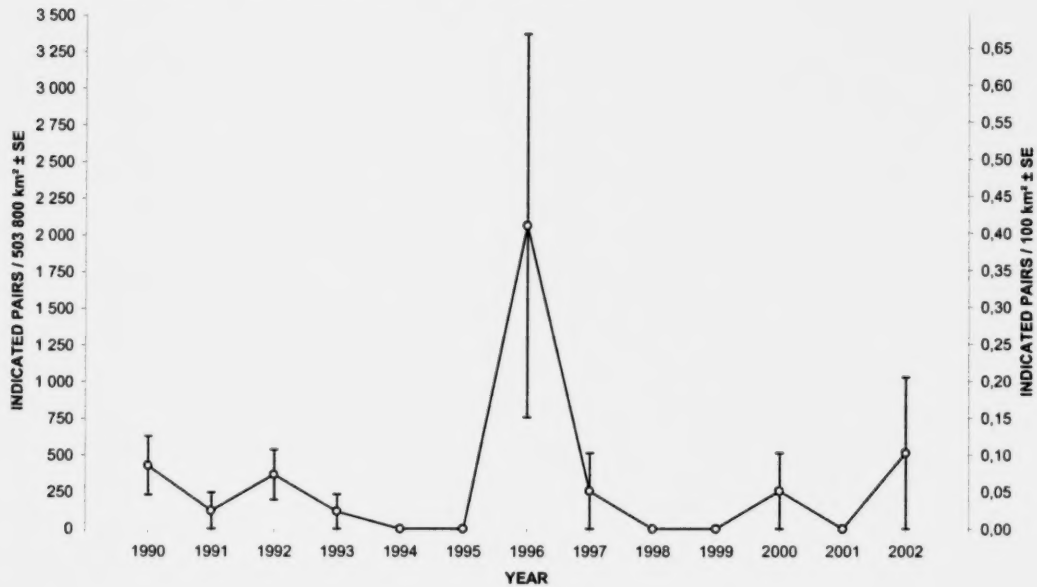


Figure 13. Trend in the Blue-winged Teal breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

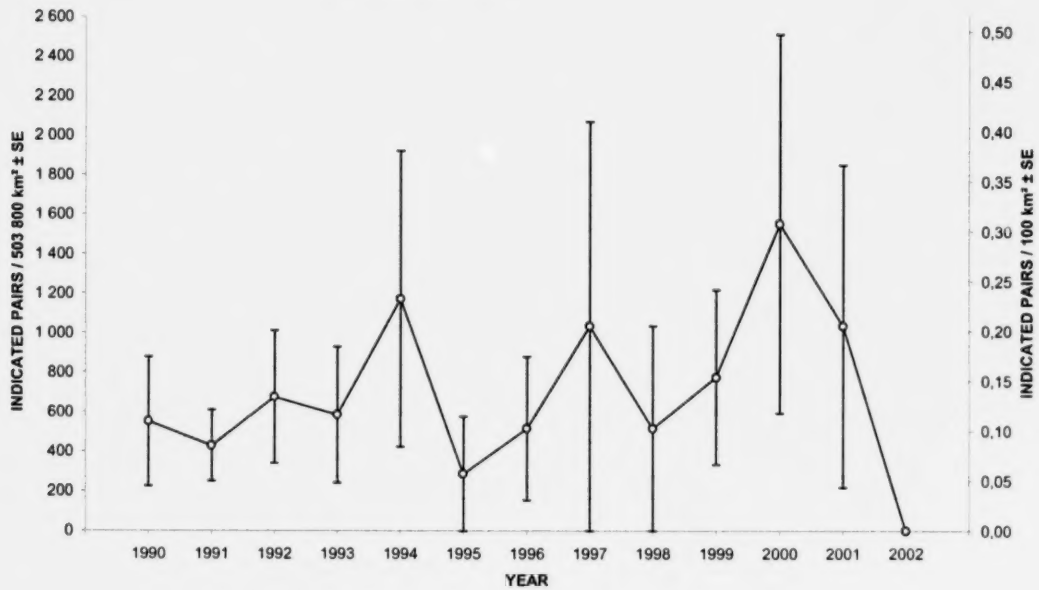


Figure 14. Trend in the American Wigeon breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

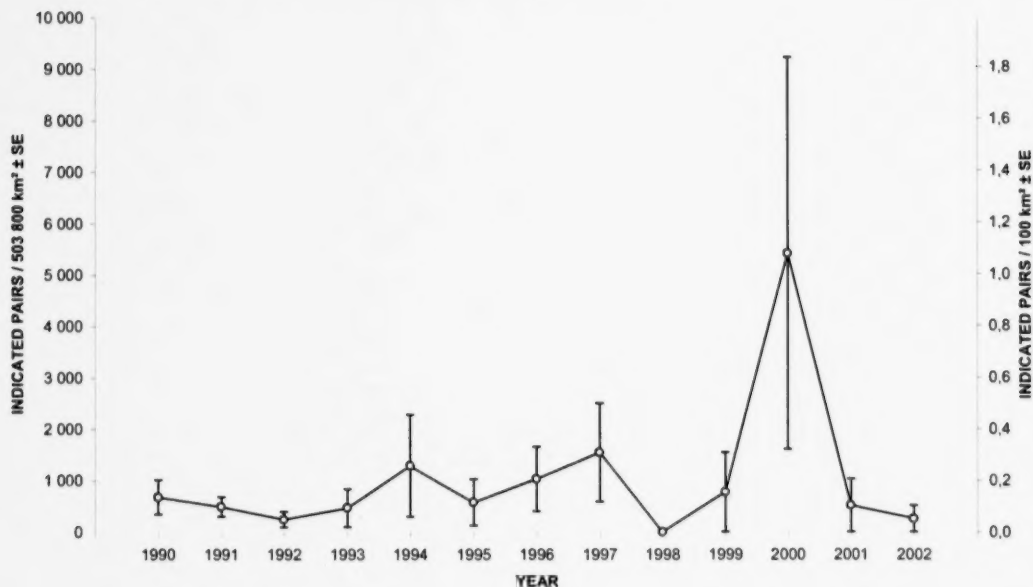


Figure 15. Trend in the Ring-necked Duck breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

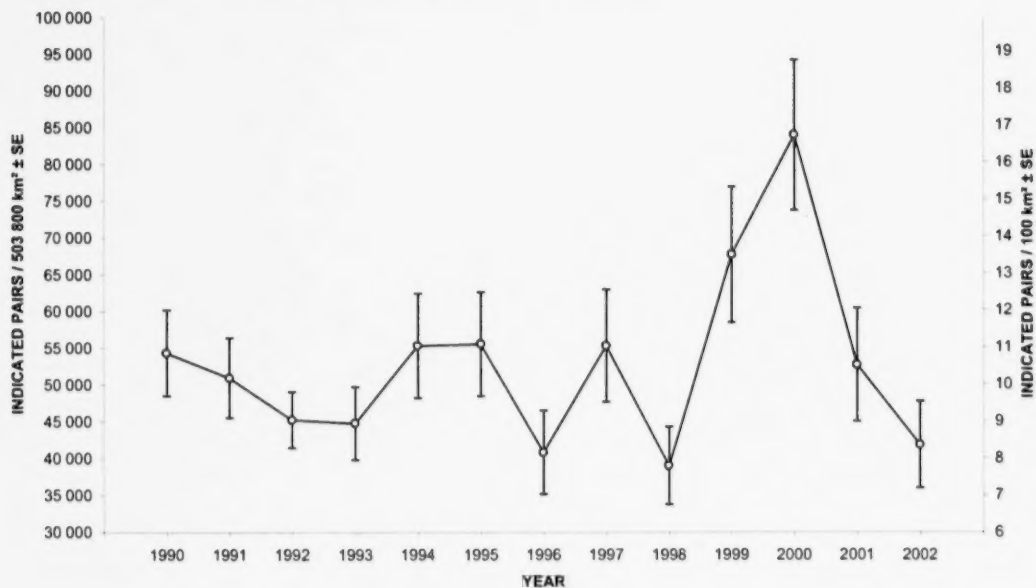


Figure 16. Trend in the Greater Scaup breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

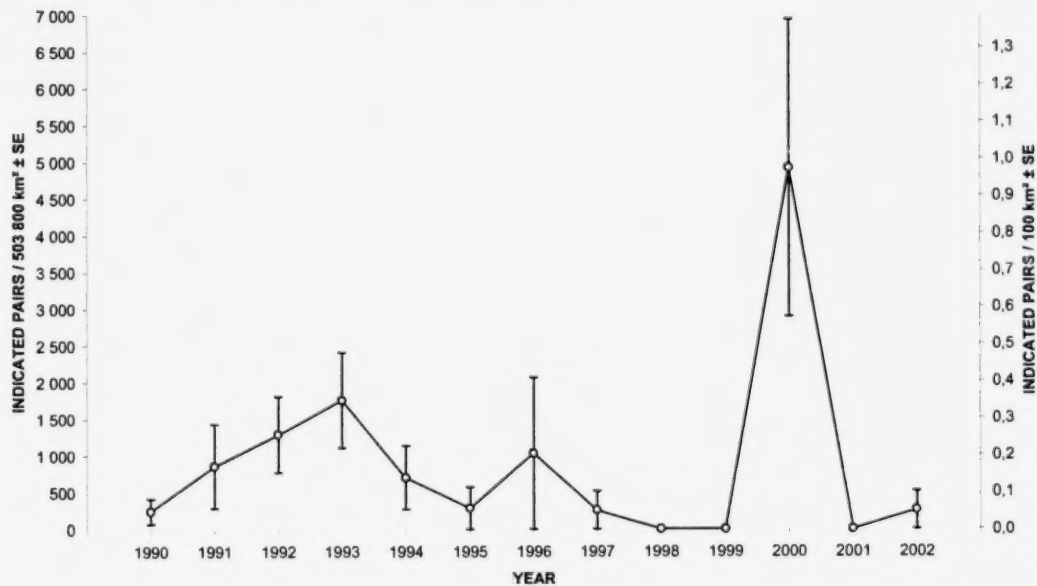


Figure 17. Trend in the Lesser Scaup breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

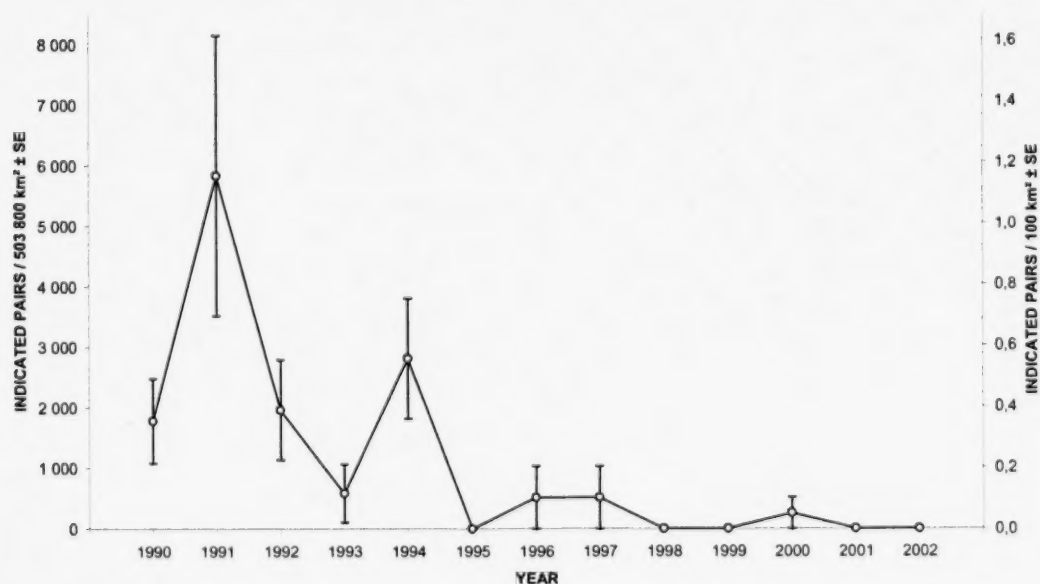


Figure 18. Trend in unidentified scaups breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

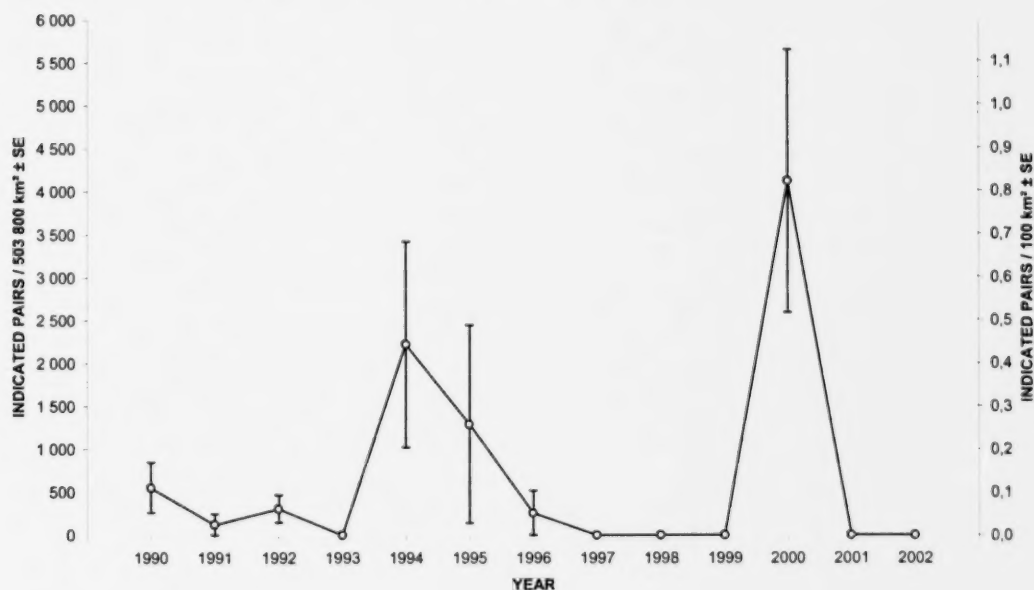


Figure 19. Trend in the scaup breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002; LESC = Lesser Scaup, GRSC = Greater Scaup, USCA = unidentified scaup, solid line = total scaup.

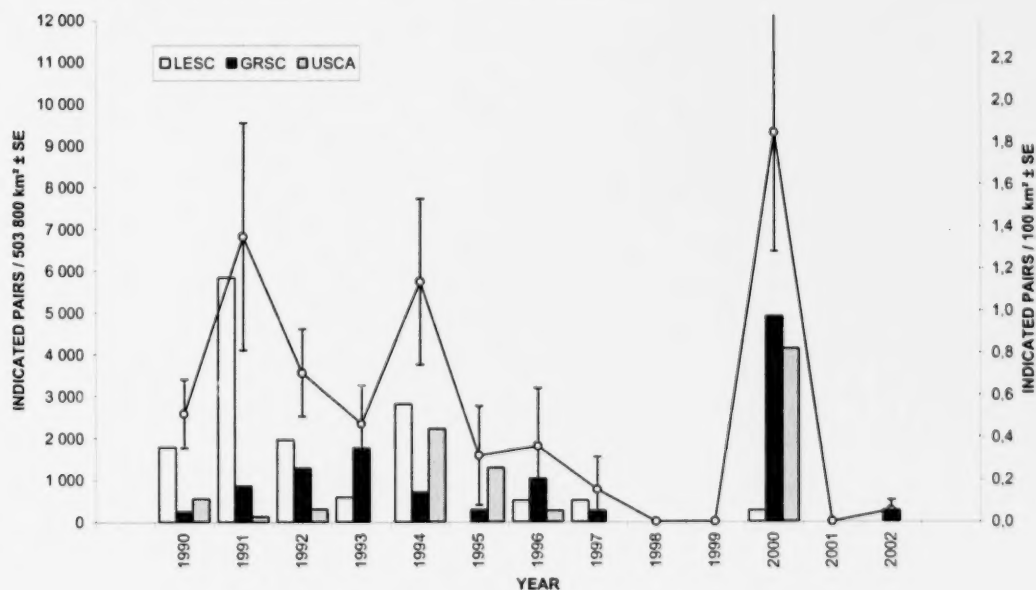


Figure 20. Trend in the Black Scoter breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

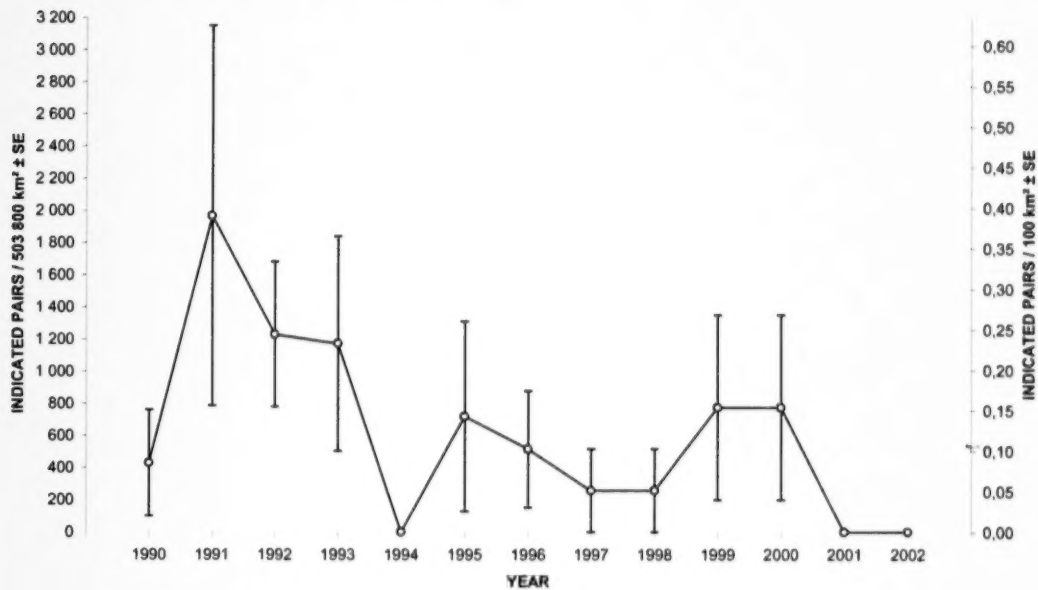


Figure 21. Trend in the Surf Scoter breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

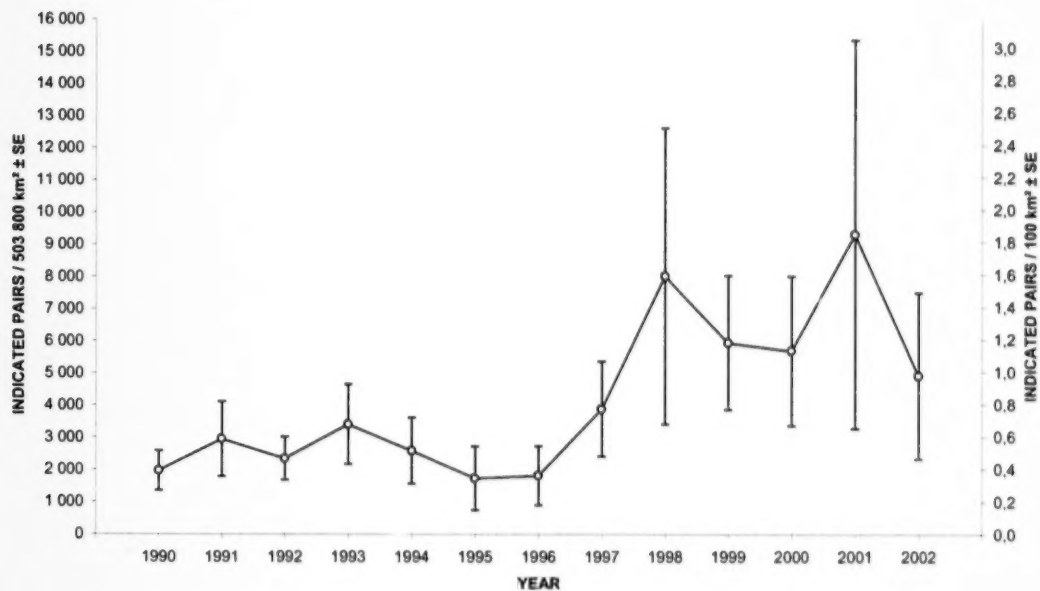


Figure 22. Trend in the Common Goldeneye breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

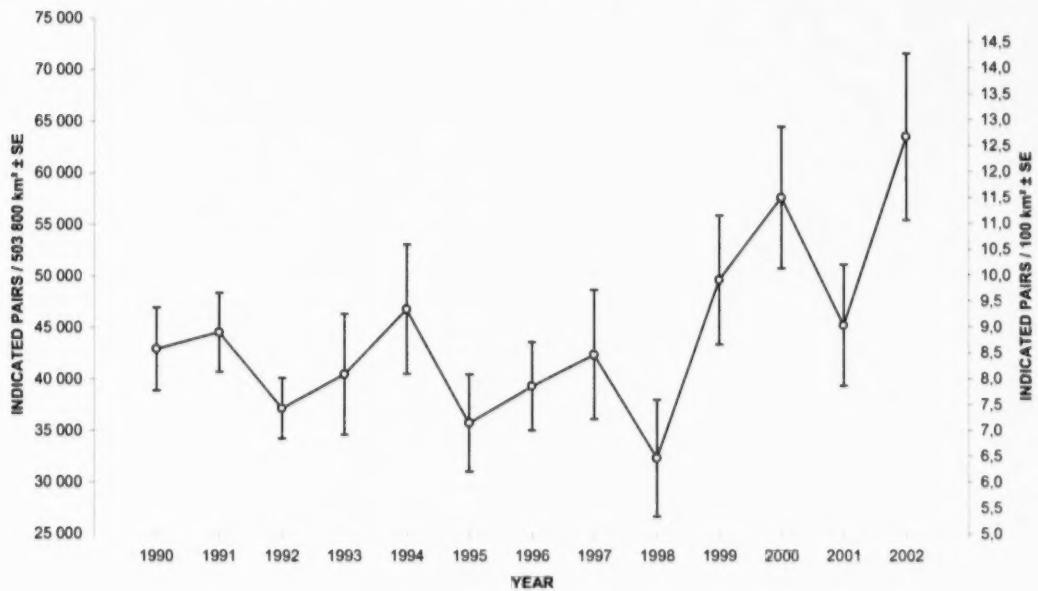


Figure 23. Trend in the Barrow's Goldeneye breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

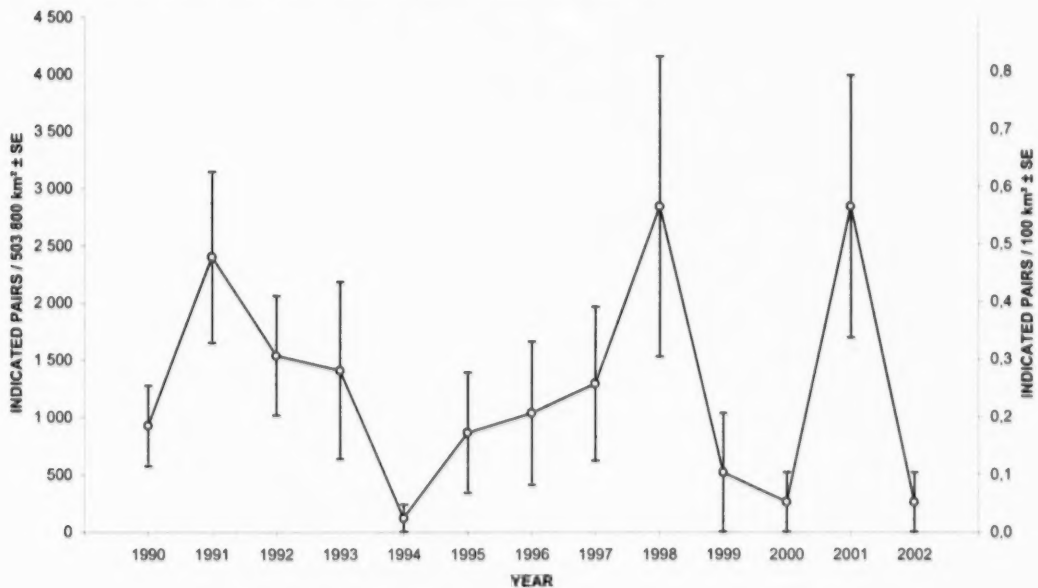


Figure 24. Trend in the Bufflehead breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

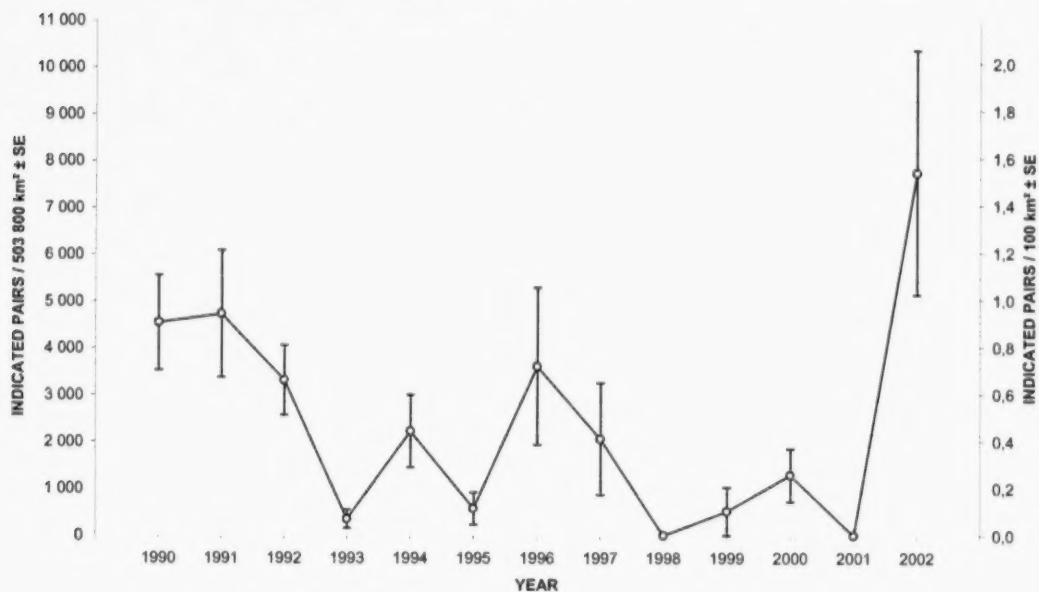


Figure 25. Trend in the Hooded Merganser breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

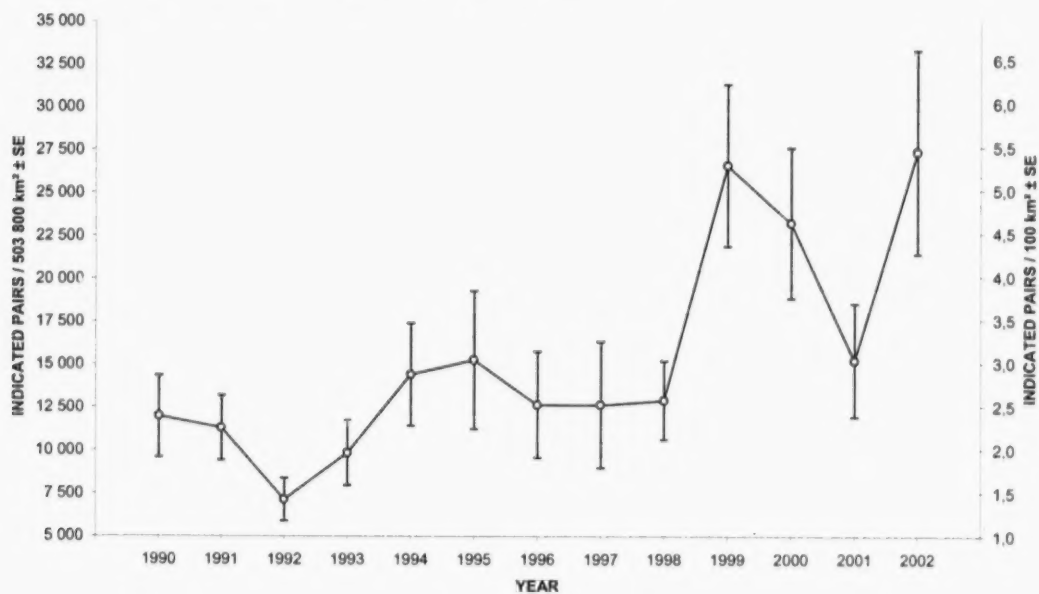


Figure 26. Trend in the Common Merganser breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002

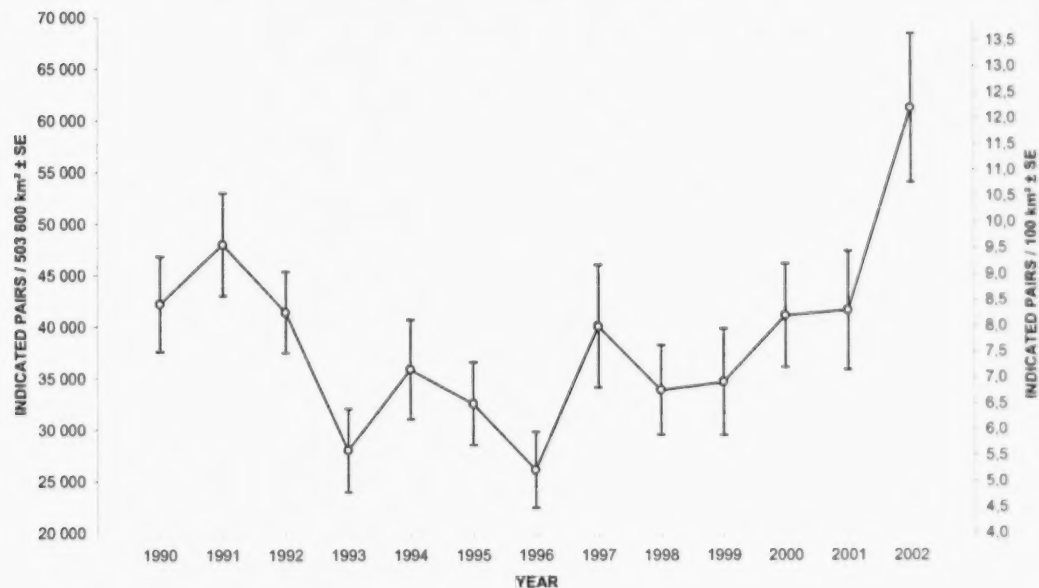
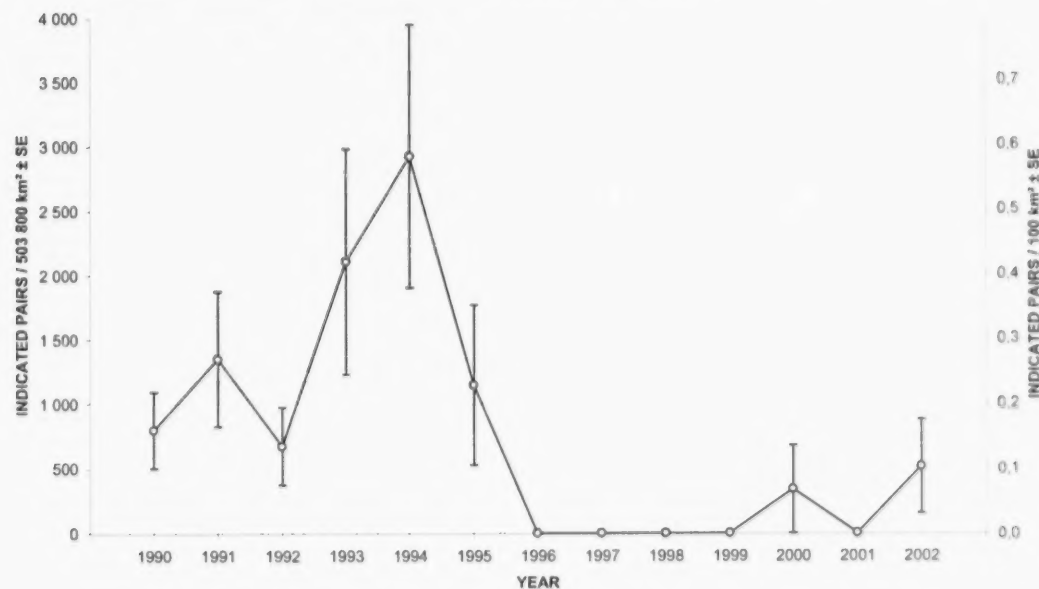


Figure 27. Trend in the Red-breasted Merganser breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2002



Appendix 1. English, French, and Scientific names of species covered by the Black Duck Joint Venture helicopter survey in southern Québec 1990-2002

English	French	Scientific
Common Loon	Plongeon huard	<i>Gavia immer</i>
Canada Goose	Bernache du Canada	<i>Branta canadensis</i>
Wood Duck	Canard branchu	<i>Aix sponsa</i>
Green-winged Teal	Sarcelle d'hiver	<i>Anas crecca</i>
American Black Duck	Canard noir	<i>Anas rubripes</i>
Mallard	Canard colvert	<i>Anas platyrhynchos</i>
Northern Pintail	Canard pilet	<i>Anas acuta</i>
Blue-winged Teal	Sarcelle à ailes bleues	<i>Anas discors</i>
American Wigeon	Canard d'Amérique	<i>Anas americana</i>
Ring-necked Duck	Fuligule à collier	<i>Aythya collaris</i>
Greater Scaup	Fuligule milouinan	<i>Aythya marila</i>
Lesser Scaup	Petit Fuligule	<i>Aythya affinis</i>
Black Scoter	Macreuse noire	<i>Melanitta nigra</i>
Surf Scoter	Macreuse à front blanc	<i>Melanitta perspicillata</i>
Common Goldeneye	Garrot à œil d'or	<i>Bucephala clangula</i>
Barrow's Goldeneye	Garrot d'Islande	<i>Bucephala islandica</i>
Bufflehead	Petit Garrot	<i>Bucephala albeola</i>
Hooded Merganser	Harle couronné	<i>Lophodytes cucullatus</i>
Common Merganser	Grand Harle	<i>Mergus merganser</i>
Red-breasted Merganser	Harle huppé	<i>Mergus serrator</i>

Appendix 2. Standardized method of calculating indicated pair (IP) from Black Duck Joint Venture helicopter survey in Eastern Canada

Sighting Combination ^a				Number of Indicated Pairs (IP)					
M	F	U	T	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
				Dabbler (except Black Duck)	American Black Duck	Diver (except Ring- necked Duck)	Ring-necked Duck	Canada Goose	Common Loon
1	0	0	1	1	1	1	1	1	1
0	1	0	1	0	1	0	0	1	1
0	0	1	1	0	1	0	0	1	1
2	0	0	2	2	1.5	2	2	1	1
1	1	0	2	1	1.5	1	1	1	1
1	0	1	2	1	1.5	1	1	1	1
0	2	0	2	0	1.5	0	0	1	1
0	1	1	2	0	1.5	0	0	1	1
0	0	2	2	0	1.5	0	0	1	1
3	0	0	3	3	3	3	3	1	0
2	1	0	3	2	3	2	2	1	0
2	0	1	3	2	3	2	2	1	0
1	2	0	3	1	3	1	1	1	0
1	1	1	3	1	3	1	1	1	0
1	0	2	3	1	3	1	1	1	0
0	3	0	3	0	3	0	0	1	0
0	2	1	3	0	3	0	0	1	0
0	1	2	3	0	3	0	0	1	0
0	0	3	3	0	3	0	0	1	0
4	0	0	4	4	4	4	4	0	0
3	1	0	4	0	4	3	3	0	0
3	0	1	4	3	4	3	3	0	0
2	2	0	4	2	4	2	2	0	0
2	1	1	4	2	4	2	2	0	0
2	0	2	4	2	4	2	2	0	0
1	3	0	4	1	4	1	1	0	0
1	2	1	4	1	4	1	1	0	0
1	1	2	4	1	4	1	1	0	0
1	0	3	4	1	4	1	1	0	0
0	4	0	4	0	4	0	0	0	0
0	3	1	4	0	4	0	0	0	0
0	2	2	4	0	4	0	0	0	0
0	1	3	4	0	4	0	0	0	0
0	0	4	4	0	4	0	0	0	0
1	x	x	>4	0	0	0	1	0	0
2	x	x	>4	0	0	0	2	0	0
3	x	x	>4	0	0	0	3	0	0
4	x	x	>4	0	0	0	4	0	0
>4	x	x	>4	0	0	0	0	0	0

^a M: male; F: female; U: unknown sex; T: total.

